Ordering number: EN 5153

Monolithic Linear IC



No. 5153

LA7685J

PAL/NTSC Single-chip Color Television Signal Processing Circuit

Overview

The LA7685J is a single-chip IC (with VIF, SIF, video, chroma, and deflection circuits built in) for use in PAL or NTSC television sets.
Because the PLL+ splitting method is used in the VIF circuit, the LA7685J is suited for use in top-of-the-line small and mid-size television sets. In addition, when used in combination with the LA7640N SECAM chroma IC, the LA7685J can be used in a PAL/NTSC/SECAM multisystem set.

Features

[VIF Block]
- PLL+ splitting (for excellent image and sound quality)
- High-gain VIF amplifier
- High-speed AGC
- APC time constant switch built in

[SIF Block]
- Simultaneous audio IN/OUT
- Video/audio simultaneous muting, or audio only muting also possible
- 1st amplifier with AGC function

[AV Switching Block]
- INT/EXT AV switch

Delay line	Video EXT, audio EXT	Switch conditions
OFF	IN	D
OFF	EXT	C
ON	EXT	B
ON	IN	A

[OSD Block]
- Three RGB inputs
- RGB linear amplifier (–6 dB input: 2 V to 5 V)
- First blanking (also used for B input)

[Chroma Block]
- ACC filter, carrier filter built in
- Ident detection output
- Killer detection output

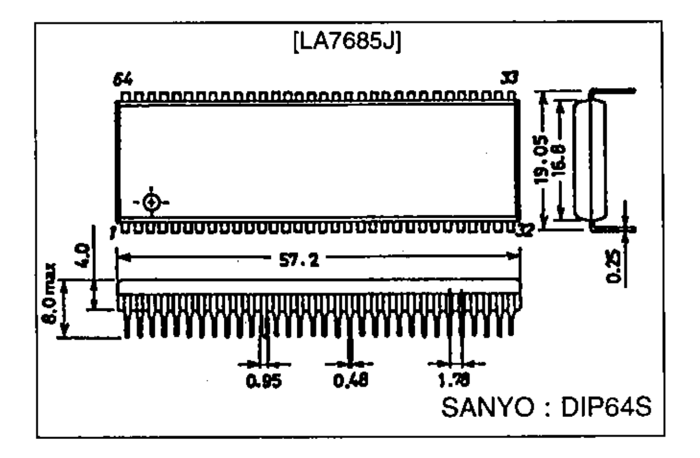
[Video Block]
- Black extension
- DC restoration
- Delay line built in
- Wide band: 9 MHz (with delay line shorted)
- Built-in double differential circuits that also enable soft tone
- Supports S input (for VCRs)
- DC transmission amount can be varied (externally adjustable)

[Deflection Block]
- Adjustment-free horizontal and vertical sync
- Excellent anti-noise characteristics due to adoption of duplex AFC
- Vertical sync sensitivity can be adjusted externally
- Constant vertical size with no signal (constant for 60/50 Hz)
- Highly stable image during copy guard tape playback (macrovision tapes, etc.)
- Excellent stability against VCR skew distortion

Package Dimensions

unit : mm

3071-DIP64S



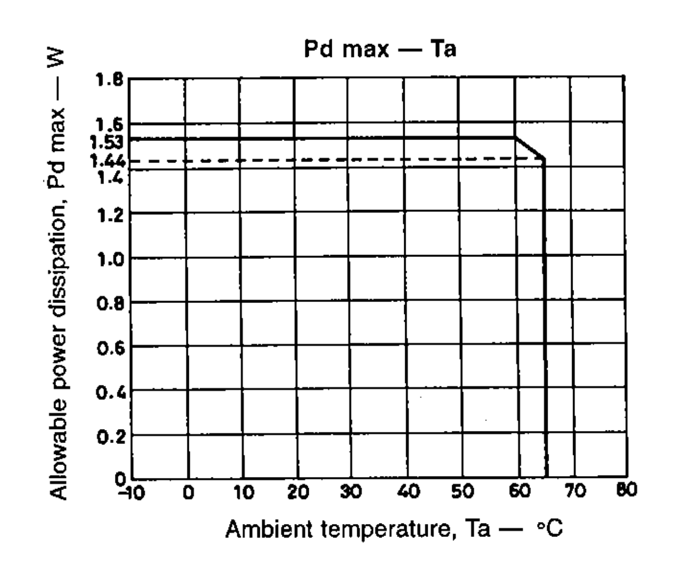
Specifications

Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_2max		11	V
	V_{12}max		11	V
Maximum supply current	I_{32}max		16	mA
Allowable power dissipation	Pd max	Ta ≦ 60 °C	1.53	W
Operating temperature	Topr		–10 to +65	°C
Storage temperature	Tstg		–55 to +150	°C
Circuit current	I_{56}		–6	mA
	I_6		–3	mA
FBP input current	I_{33}max	Peak current	5	mA
	I_{27}max	Peak current	10	mA

Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_2		9	V
	V_{12}		9	V
Recommended supply current	I_{32}		13	mA
Operating supply voltage range	V_2op		8 to 9.5	V
	V_{12}op		8 to 9.5	V
Operating supply current range	I_{32}op		10 to 16	mA



Electrical Characteristics at Ta = 25 °C, $V_{CC} = V_2 = V_{12} = 9$ V, $I_{CC} = I_{32} = 13$ mA

Parameter	Symbol	Conditions	min	typ	max	Unit
[Circuit Voltage, Current]						
Horizontal supply voltage	V_{32}	V_{CC} = 9 V, I_{CC} = 13 mA	7.1	7.6	8.1	V
Supply current	I_{2+12}	V_{CC} = 9 V, I_{CC} = 13 mA, I_FAGC = 4 V	102	120	138	mA
[VIF Block] fp = 38.9 MHz						
Video output voltage with no signal	V_{56}	No signal	4.3	4.7	5.1	V
AFT output voltage with no signal	V_{60}	No signal	3.0	4.5	6.0	V
Maximum RF AGC voltage	V_{5H}	CW = 85 dBμ, RF AGC VR = min	7.6	8.0	8.3	V
Minimum RF AGC voltage	V_{5L}	CW = 85 dBμ, RF AGC VR = max	0	0.01	0.3	V
Input sensitivity	Vi	Video output is 0.8 Vp-p (40 % MOD), VIF input level	33	39	45	dBμ
AGC range	GR	Maximum input (V_0 = 0.8 Vp-p) – Input sensitivity	54	62		dB
Maximum allowable input	Vi max	Video output is +1 dB. VIF input level	97	104		dBμ
Video output amplitude	V_{O56}	Vi = 80 dBμ, AM = 78 % MOD	1.7	2.0	2.3	Vp-p
Differential gain	DG	Vi = 80 dBμ, 87.5 %, VIDEO MOD		3.0	10	%
Differential phase	DP	Vi = 80 dBμ, 87.5 %, VIDEO MOD		1.0	10	deg
Video S/N	S/N	Vi = 80 dBμ, 20 log $\frac{1.46\ (Vp\text{-}p)}{Noise\ (Vrms)}$	47	54		dB
Sync signal tip level	$V_{56\ TIP}$	CW = 80 dBμ	2.1	2.4	2.7	V
Frequency characteristics	f_C	Frequency when video output is –3 dB	6.5	8.0		MHz
1.07 kHz beat level	$I_{1.07}$	V4.43 MHz/V1.07 MHz, Vi = 80 dBμ	35	50		dB
Maximum AFT output voltage	V_{60H}	CW = 80 dBμ, frequency change	7.6	8.0	8.4	V
Minimum AFT output voltage	V_{60L}	CW = 80 dBμ, frequency change	0.6	1.0	1.4	V
AFT detection sensitivity	Sf	CW = 80 dBμ, frequency change	50	80	110	mV/kHz
AFT defeat start voltage	$V_{AFT\ SW}$	Measure with sweep signal	0.5	1.0		V
Black noise threshold level	V_{BTH}	Measure with sweep signal	1.1	1.4	1.7	V
APC pull-in range (U)	f_{PU}	CW = 80 dBμ, fp = 34 MHz to 44 MHz	0.8	1.7		MHz
APC pull-in range (L)	f_{PL}	CW = 80 dBμ, fp = 53 MHZ to 64 MHz		–2	–1	MHz
VCO maximum variable range	Δf_U	No signal	0.9	1.7		MHz
	Δf_L	No signal		–2	–1	MHz
VCO control sensitivity	β	No signal	1.3	2.5	5.3	kHz/mV
[AVSW Block]						
Image output DC voltage	V_{50}	No signal	3.0	3.4	3.8	V
Internal image input voltage	V_{54}	No signal	4.4	4.8	5.2	V
External image input voltage	V_{52}	No signal	4.4	4.8	5.2	V
External audio input voltage	V_4	No signal	5.2	5.6	6.0	V
[1st SIF Block]						
5.5 MHz conversion gain	VG	Vi = 70 dBμ, 33.4 MHz	21	26	31	dB
Output level	V_{59}	Vi = 10 mV, 33.4 MHz	210	320	480	mVp-p
Maximum input level	V_{11}max	f_S = 33.4 MHz	96	101		dBμ
[SIF ATT Block] f_S 5.5 MHz						
SIF limiting voltage	Vi lim	SIF input when detection output is –3 dB.		40	47	dBμ
FM detection output voltage	V_{O1}	Vi = 100 dBμ, Δf = ± 30kHz	390	500	630	mVrms
FM dectection output distortion	THD	Vi = 100 dBμ, Δf = ±30 kHz		0.4	1.0	%
AM rejection ratio	AMR	Vi = 100 dBμ, $\frac{FM : \Delta f = \pm 30\ kHz}{AM : 30\ \%}$	40	60		dB
ATT voltage gain	G_{AF}	Vi = 1 Vrms, f = 400 Hz	–1	0	1	dB
Maximum attenuation of electronic volume control	ATT	Vi = 2 Vrms, f = 400 Hz	70	80		dB
[Video Block]						
Black extension threshold	BS_{TH}	APL variable, input 0.5 Vp-p	40	50	60	IRE
Maximum black extension gain	BSmax	APL variable, input 0.5 Vp-p	–30	–22	–13	IRE
Soft video tone variable range	ΔSoft	f = 2 MHz, 100 mVp-p Video tone V_R : 4 V → 0 V	–6	–4	–2	dB

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Parameter	Symbol	Conditions	min	typ	max	Unit
Sharp video tone variable range	ΔSharp	f = 2 MHz, 100 mVp-p, video tone V_R : 4 V → 9 V, contrast V_R : 6 V	7	10	13	dB
Video voltage gain AC switch 9 V	GV_{9V}	f = 100 kHz, 100 mVp-p, contrast V_R : 9 V, video tone V_R : 4 V	15	18	21	dB
Video voltage gain AV switch 0 V	GV_{0V}	f = 100 kHz, 100 mVp-p, contrast V_R : 0 V, video tone V_R : 4 V	15	18	21	dB
Contrast control center	C_{CEN}	f = 100 kHz, 100 mVp-p, contrast V_R : 6 V	0.35	0.44	0.53	Vp-p
Contrast control variable range	ΔC_V	Contrast V_R : 3 V → 9 V	22	24	26	dB
Bright control	BR_H	Bright V_R : 2.0 V	5.5	6.5	7.5	V
	BR_{CEN}	Bright V_R : 5.25 V	2.3	2.8	3.3	V
	BR_L	Bright V_R : 7.5 V		0.5	1.5	V
Frequency characteristics D.L.ON	f_{V0V}	Contrast V_R : 6 V, video tone V_R : 4 V, 3 dB down	4.5	6		MHz
DC transmission amount	R_{DC}	Input : STAIR STEP signal, 200 mVp-p	88	93		%
Delay line delay amount (one level)	T_{DL1}	Input : WHITE 100 %	300	350	400	ns
Delay line delay amount (two levels)	T_{DL2}	Input : WHITE 100 %	370	420	470	ns
[Chroma Block PAL/NTSC Common]						
Color control color residue	$E_C min$	Color V_R : 0 V, contrast V_R : 9 V			30	mVp-p
Color contrast variable range	ΔC_C	Color V_R : B-Y = 2.5 Vp-p, contrast V_R : 3 V → 9 V	18.5	20	21.5	dB
Demodulation output DC voltage	V_{C-Y}	Burst signal only, color V_R : 0 V	4.8	5.3	5.8	V
Demodulation output DC difference voltage	ΔV_{C-Y}	Burst signal only, color V_R : 0 V	–300	0	+300	mV
Demodulation output carrier leakage	Ecar	No signal, killer off, color V_R : 0 V			0.03	Vp-p
APC pull-in range	ΔF_{APC}		±500			Hz
Kill output	V_{KiOUT}				0.35	V
[Chroma Block PAL]						
Color control center	E_{CCEN}	Color V_R : 4.5 V, contrast V_R : 6 V	1.5	2.0	2.5	Vp-p
ACC amplitude characteristics	ACC_{M1P}	+6 dB	–3	0	+3	dB
	ACC_{M2P}	–20 dB	–5	–1	+1	dB
Demodulation output ratio	B/Rp		1.10	1.35	1.60	
	G/Rp	B-Y no signal	–0.56	–0.51	–0.46	
	G/Bp	R-Y no signal	–0.21	–0.19	–0.17	
Demodulation angle	RBp		85	90	95	deg
Maximum chroma output	Ech	Color V_R : 9 V, contrast V_R : 9 V	1.5	2.0	2.5	Vp-p
Maximum demodulation output	$E_C max$	Color V_R : 9 V, contrast V_R : 9 V	3.6	4.2		Vp-p
Killer operating point	E_{KONP}		–37	–33	–29	dB
PAL output					0.3	V
[Chroma Block NTSC]						
Color control center	E_{CEN}	Color V_R : 4.5 V, contrast V_R : 6 V	1.4	1.9	2.4	Vp-p
ACC amplitude characteristics	ACC_{M1N}	+6 dB	–3	0	+3	dB
	ACC_{M2N}	–20 dB	–3	0	+3	dB
ACC phase characteristics	ACC_{P1N}	+6 dB	–3	0	+3	deg
	ACC_{P2N}	–20 dB	–7	0	+7	deg
Tint center	T_{CEN}	Tint V_R = 4.5 V, color V_R : 4.5 V, contrast V_R : 6 V	–12	0	+12	deg
Tint variable range	ΔT	Tint V_R : 0 V ← 4.5 V → 9 V, color V_R : 4.5 V, contrast V_R : 6 V	±35			deg
Demodulation output ratio	R/B_N		0.82	0.91	0.99	
	G/B_N		0.18	0.25	0.32	
Demodulation angle	RB_N		99	105	111	deg
	GB_N		–130	–120	–110	deg
Maximum demodulation output	$E_C max_N$	Color V_R : 9 V, contrast V_R : 9 V	3.5	4.1		Vp-p
Kill operation point	E_{KONN}		–39	–35	–31	dB
NTSC/SECAM output	E_{KONN}		1.4	1.9	2.4	V

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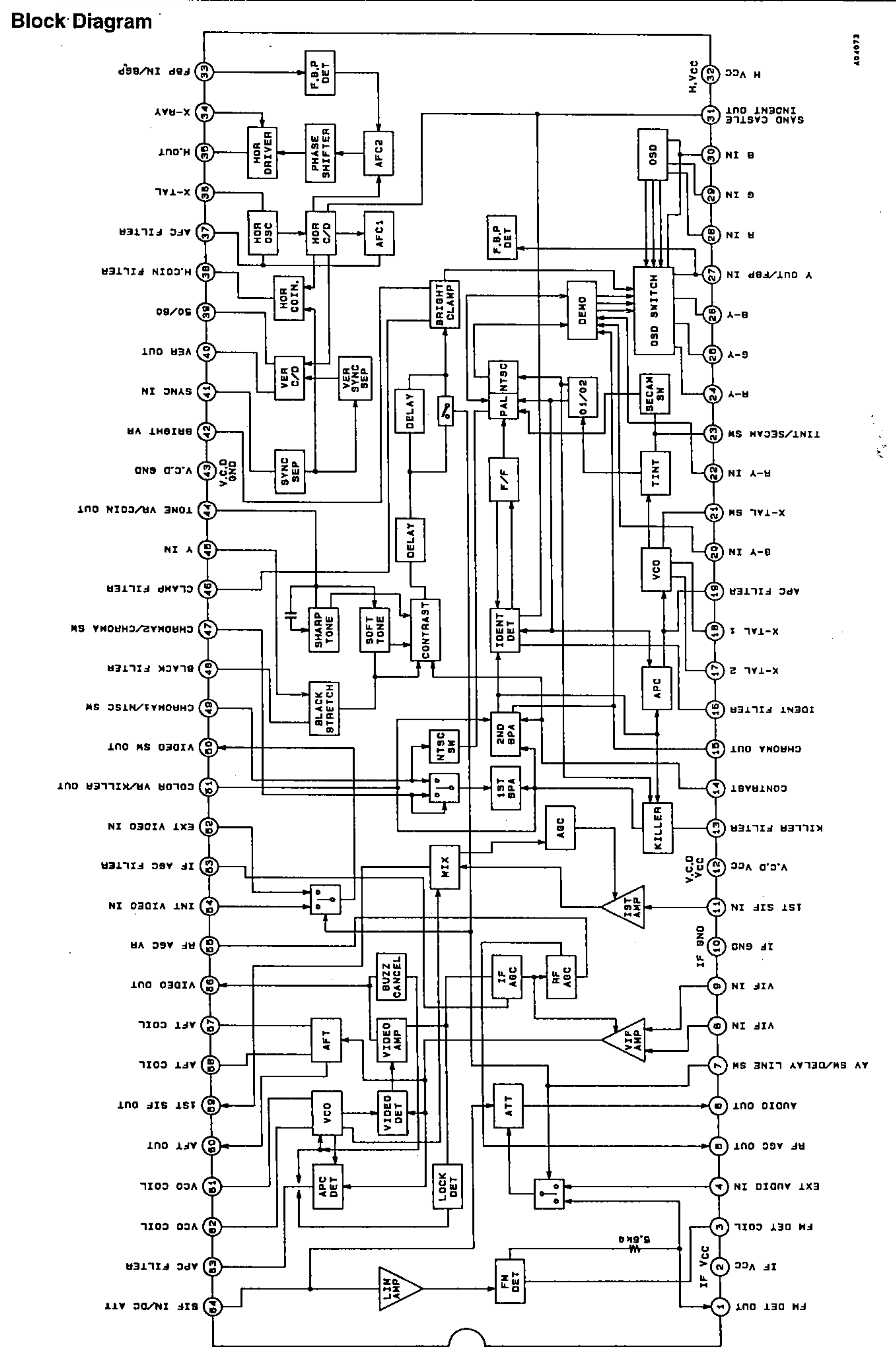
Parameter	Symbol	Conditions	min	typ	max	Unit
[Deflection Block]						
Sync separation input voltage	$V_{S\ DC}$		6.0	6.3	6.6	V
Vertical free-running frequency	$T_V free_{50}$		312.0	312.5	313.0	H
	$T_V free_{60}$		262.0	262.5	263.0	H
Vertical sync maximum period	$T_V max_{50}$	Horizontal sync signal only	356.5	357	357.5	H
	$T_V max_{60}$	Horizontal sync signal only	296.5	297	297.5	H
Vertical sync minimum period	$T_V min_{50}$		268.5	269	269.5	H
	$T_V min_{60}$		224.5	225	225.5	H
Vertical blanking pulse peak value	V_{HVBL}		7.0	7.5		V
Vertical blanking pulse width	P_{WBLK50}		21.0	21.5	22.0	H
	P_{WBLK60}		17.0	17.5	18.0	H
Vertical output pulse width	P_{WVOUT}		8.0	8.5	9.0	H
Vertical output voltage	$V_{OUT\ H}$		5.7	6	6.3	V
	$V_{OUT\ M}$		4.3	4.6	4.9	V
	$V_{OUT\ L}$				0.3	V
Vertical external trigger load resistance	R_{TR}		2.5	3.6		kΩ
Vertical automatic sync stop voltage	V_{SAS}		1.2	1.4	1.6	V
Vertical output pulse start V_{CC} voltage	S_{VV}				4	V
Horizontal free-running frequency deviation	Δf_H	Deviaton from 15.680 kHz	–100	0	+100	Hz
Dependence of horizontal free-running frequency on V_{CC}	Δf_{HVCC}	V25 = 6.5 V, reference value		2		Hz
Horizontal pull-in range	f_{HPULL}	Deviation from 15.680 kHz	±450			Hz
Horizontal output pulse start V_{CC} voltage	S_{HV}			4.8	5.5	V
AFC II FBP peak value	FBP_H		4.1	4.6	5.1	V
VCR switch input voltage	VCR			0.7	0.9	V
Horizontal output pulse width	P_{WHOUT}		21.8	23.8	25.8	μs
Horizontal output pulse phase	H_{PF}		12			μs
	H_{PCEN}		3.4	4.4	5.4	μs
	H_{PR}				0	μs
Burst gate pulse width	P_{WBGP}		2.7	3.7	4.7	μs
Burst gate pulse phase	Td_{BGP}		0.2	0.6	1.2	μs
Horizontal sync detection threshold level	Hcoin		4.2	4.5	4.8	V
50/60 output voltage	V_{50}			0.5	0.7	V
	V_{60}		4.0	4.7		V
50/60 input voltage	Vin_{50}				0.5	V
	Vin_{60}		7.2			V
X ray protection circuit operation input voltage	V_{HD}		0.64	0.74	0.84	V
Sandcastle H.BLK peak value	$V_{H\ SHBL}$		3.7	4.0	4.3	V
Sandcastle BGP peak value	$V_{H\ SBGP}$		7.7	8.0	8.3	V
Sandcastle BP peak value	$V_{H\ SBP}$		5.7	6.0	6.3	V
Sandcastle BGP width	$P_{W\ SBGP}$		1.4	1.9	2.4	μs
Sandcastle BGP phase	Td_{SBGP}		1.7	2.2	2.7	μs
Sandcastle field ID width	$P_{W\ SFID}$		11.5	12	12.5	H
Sandcastle H.BLK width 50	$P_{W\ SHBL50}$		11.0	12.0	13.0	μs
Sandcastle H.BLK width 60	$P_{W\ SHBL60}$		10.0	11.0	12.0	μs

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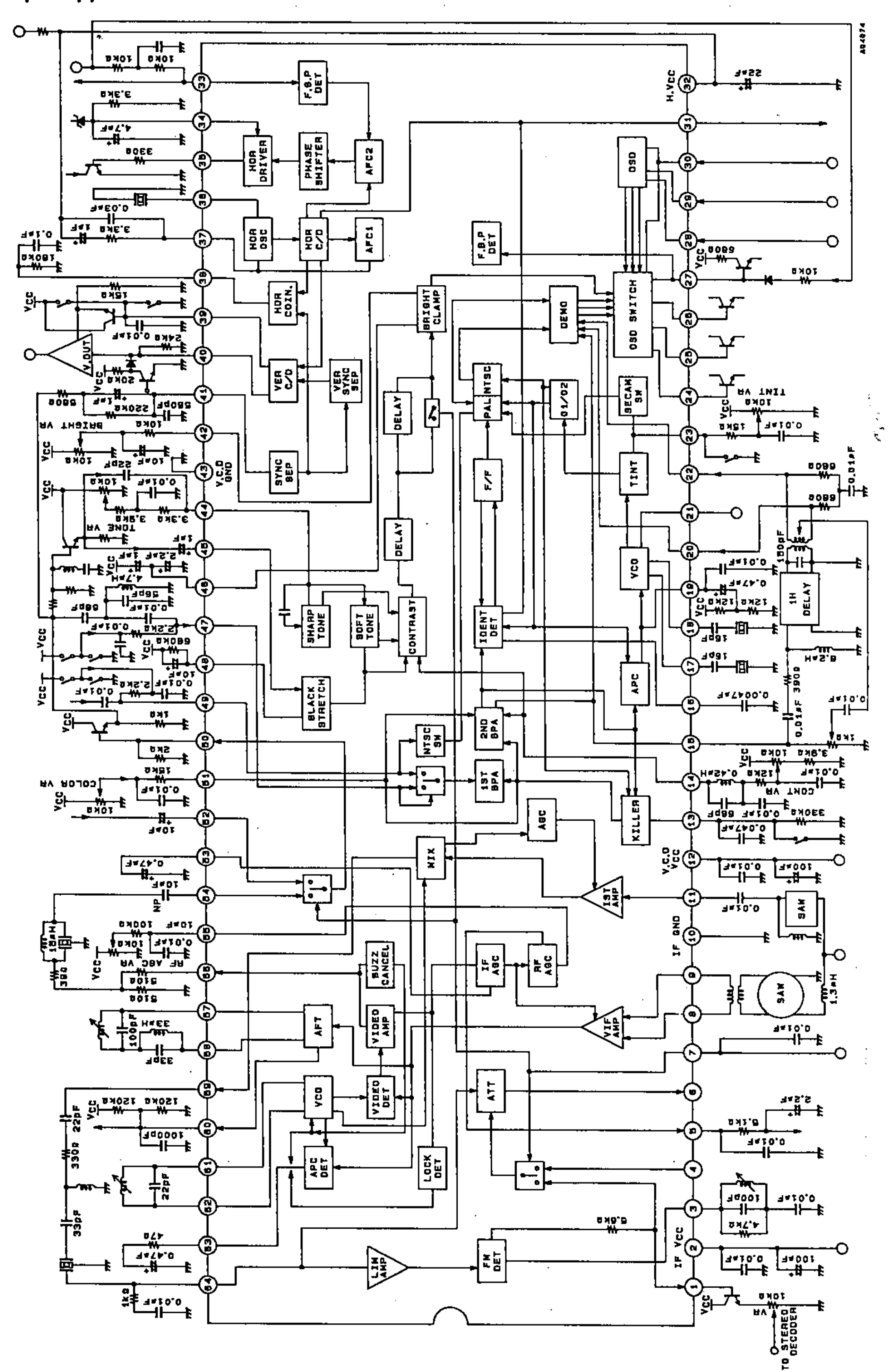
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Parameter	Symbol	Conditions	min	typ	max	Unit
[OSD Block]						
Blanking pulse threshold level	TH_{BL}	C-IN : color bar, B-IN : variable	0.6	0.9	1.2	V
–Y OUT DC voltage (OSD mode)	V_{-Y}	B-IN : 1.5 V	2.4	2.7	3.0	V
R.G.B. –IN threshold level	TH_R	R-IN : variable, B-IN : 1.5 V	1.4	1.7	2.0	V
	TH_G	G-IN : variable, B-IN : 1.5 V				
	TH_B	B-IN : variable				
R.G.B. –Y OUT DC voltage (3 V)	V_{R3V}	R, G, B-IN : 3 V	5.2	5.5	5.8	V
	V_{G3V}					
	V_{B3V}					
R.G.B. –Y OUT DC voltage (4 V)	V_{R4V}	R, G, B-IN : 4 V	5.8	6.1	6.4	V
	V_{G4V}					
	V_{B4V}					
R.G.B. –Y OUT DC voltage (5 V)	V_{R5V}	R, G, B-IN : 5 V	6.3	6.6	6.9	V
	V_{G5V}					
	V_{B5V}					

Block Diagram



Sample Application Circuit



LA7685J and LA7640N Connection Diagram (Reference)

Unit (resistance: Ω, capacitance: F)

